FINAL CORRECTIVE MEASURES IMPLEMENTATION REPORT

For

AMETEK, U.S. Gauge, Inc.
900 Clymer Avenue
Sellersville, Pennsylvania

Prepared For:

AMETEK, Inc.
1100 Cassatt Road
Berwyn, Pennsylvania 19312

Prepared By:

Langan Engineering and Environmental Services, Inc.
2700 Kelly Road, Suite 200
Warrington, Pennsylvania 18976

May 8, 2013
220051801

LANGAN

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Purpose 2
1.2 Site Regulatory History 2
1.2.1 Prior to the Consent Order 2
1.2.2 Consent Order 3
1.2.3 RCRA Facility Investigation 4
1.2.4 Corrective Measures Study 7
1.3 Final Remedy 15
1.4 Report Organization 15
2.0 CURRENT GROUNDWATER SITE CONDITIONS 16
2.1 Site Conceptual Model 16
2.2 Discussion of Site Annual TI Groundwater Compliance Sampling 18
2.2.1 Scope of the Site Groundwater Sampling Events Conducted in March 2011 and April 2012 21
2.2.2 March 2011 Site Groundwater Sampling Event Findings and Discussion 25
2.2.3 April 2012 Site Groundwater Sampling Event Findings and Discussion 29
2.3 Groundwater Potentiometric Surfaces 35
2.3.1 March 2011 Potentiometric Surfaces 37
2.3.2 April 2012 Potentiometric Surfaces 39
2.3.3 Summary of Observations – Groundwater Potentiometric Surfaces 41
2.4 Existing Groundwater Treatment System 42
3.0 SELECTED REMEDY 44
3.1 Technical Impractibility Zone 44
3.2 Groundwater Pump and Treat System 46
3.3 Long- term Groundwater Monitoring 47
3.4 Institutional Controls 48
4.0 REPORTING REQUIREMENTS 48
4.1 System Performance Criteria 49
5.0 REFERENCES 51

TABLES

Table 1	Summary of Analytical Results – VOCs, March 2011 Sampling Event
Table 2	Summary of Analytical Results – 1,4-Dioxane, March 2011 Sampling Event
Table 3	Summary of Analytical Results – VOCs, April 2012 Sampling Event
Table 4	Summary of Analytical Results – 1,4-Dioxane, April 2012 Sampling Event
Table 5	Groundwater Gauging Summary, March 28, 2011
Table 6	Groundwater Gauging Summary, April 18, 2011

FIGURES

Figure 1	Site Location Map
Figure 2	TI Boundary Monitoring Well Network
Figure 3	PBA Wells Number 10 and 11 Zone II Wellhead Protection Areas
Figure 4	Geologic Cross-Section Location
Figure 5	Site Stratigraphy Cross-Section
Figure 6	Shallow Aquifer VOC Results – March 2011 and April 2012
Figure 7	Deep Aquifer South VOC Results – March 2011 and April 2012
Figure 8	Deep Aquifer North VOC Results – March 2011 and April 2012
Figure 9	Groundwater Potentiometric Map - Shallow Aquifer March 2011
Figure 10	Groundwater Potentiometric Map - Deep Aquifer South March 2011
Figure 11	Groundwater Potentiometric Map - Deep Aquifer North March 2011
Figure 12	Groundwater Potentiometric Map - Shallow Aquifer April 2012
Figure 13	Groundwater Potentiometric Map - Deep Aquifer South April 2012
Figure 14	Groundwater Potentiometric Map - Deep Aquifer North April 2012

APPENDICES

Appendix A	Groundwater Analytical Data
Appendix B	Groundwater Analytical Data Validation Reports
Appendix C	Groundwater Monitoring Well Sampling Logs
Appendix D	Operation and Maintenance Form

1.0 INTRODUCTION

This final Corrective Measure Implementation Report (CMI) has been prepared for the former AMETEK, U.S. Gauge Division (AMETEK) Plant Number 2 located at 900 Clymer Avenue in Sellersville, Pennsylvania (Site). The Site went through the Resource Conservation and Recovery Act (RCRA) corrective action process under the Final Administrative Order on Consent (Consent Order, Docket Number RCRA-III-030CA), issued to AMETEK) on June 11, 1990 by the United States Environmental Agency (EPA) under Section 3008(h) of the RCRA, amended by the Hazardous and Solid Waste Amendments of 1984, U.S.C. Section 6928(h). The Consent Order was signed by AMETEK on June 29, 1990 and was fulfilled at the conclusion of the Final Decision (i.e., Final Remedy) issued by the EPA on June 8, 2012. This document details the work performed by AMETEK to fulfill the requirements of the CMI in accordance with the Final Remedy. Included in this CMI report are the results of the groundwater monitoring events conducted in March 2011 and April 2012 which were implemented after the Corrective Measures Study (CMS) report was issued in January 2012 to the EPA. The final CMI report addresses the EPA comments provided in the electronic mail dated April 11, 2013 on the draft CMI report dated February 22, 2013.

The Site which is the subject of the CMI was the location of a pressure and vacuum gauge manufacturing business since 1957. Manufacturing operations ceased in 2008. From 2008 to 2011 the Site was used only for administrative and engineering offices and as a warehouse for the storage, shipping and receiving of various metal components. In calendar year 2012, all building structures on the Site were demolished, except for the concrete foundations and slabs which were left intact. All utilities were disconnected and terminated on the Site. As part of the pre-demolition decontamination activities, residual (sludge type) material in the former plating area was sampled and determined to contain polychlorinated biphenyls (PCB's) at levels over the EPA Toxic Substances Control Act (TSCA) limit. Following the demolition activities, this plating area was decontaminated and remediated to levels that are acceptable to the EPA for un-restrictive use (EPA approval letter dated January 15, 2013).

The Site location is displayed in Figure 1 and the Site layout is depicted in Figure 2. Machining of metal components, solvent degreasing and metal electroplating operations were associated with the facility manufacturing processes. Past operational practices related to the use of solvent degreasers, including trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), have resulted in the degradation of the groundwater at the Site. The groundwater is the media of concern for the Final Remedy. Other media such as soil, sediment, surface water and indoor air were addressed under the RCRA Facility Investigation (RFI) and do not require corrective measures (RFI Addendum report, dated June 2008, by Malcolm Pirnie, Inc.).

1.1 Purpose

The purpose of this CMI report is to describe the goals of the Final Remedy in accordance the EPA Final Decision, the various corrective action components of the Final Remedy, the annual reporting requirements, as well as the operational and maintenance (O&M) requirements for the Site.

1.2 Site Regulatory History

This section provides a brief overview of the environmental activities conducted at the facility from "1990 to current time" relative to RCRA-related tasks. A more in depth discussion is provided in the "Final Corrective Measures Study Report, January 28, 2011 (CMS report) and the EPA Statement of Basis document dated August 23, 2011 (SB report). This section has been organized into activities conducted prior to the Consent Order (see Section 1.2.1), and during the Consent Order (see Section 1.2.2).

Several environmental activities have been performed at the Site since 1974 to investigate, remove and control subsurface impacts at the Site. Documentation of these pre-1990 activities can be found in the RFI documentation (e.g., RFI Work Plan report, RFI Addendum report, etc.).

1.2.1 Prior to the Consent Order

In response to the Pennsylvania Department of Environmental Protection (PADEP) Order issued to AMETEK in September 1988, a Phase I hydrogeological investigation was conducted in 1988 through 1989 (*Preliminary Report of Results; Hydrogeological Investigation*, 1990). The results confirmed the presence of volatile organic compounds (VOCs) in groundwater at the Site. In February 1990, the EPA informed AMETEK that the primary regulatory responsibility for further investigation and remedial efforts at the Site was being assumed by the EPA at the request of the PADEP. The Consent Order, signed on June 29, 1990 by the EPA and AMETEK, specified the performance of a Phase II Hydrogeological Investigation and other requirements.

1.2.2 Consent Order

In December 1991, AMETEK completed a Phase II Hydrogeological Investigation (HI) of the Site under the terms of the Consent Order and submitted a Draft HI Report to the EPA (Draft Hydrogeological Investigation Report, 1991). The Draft HI Report indicated that off-Site migration of dissolved phase Site-related VOCs could be occurring. The EPA concluded that the HI did not fulfill the requirements of a RFI, and identified issues that would need to be addressed. AMETEK addressed the EPA's comments during performance of the RFI.

1.2.2.1 Interim Remedial Measures

Interim Remedial Measures (IRMs) completed as part of the Consent Order included the design, installation, and operation of an IRM groundwater extraction and treatment system (i.e., the Site's existing groundwater treatment system), and a residential water supply survey. The existing groundwater treatment system has been in operation since July 1993. Details on the current operation of the existing groundwater treatment system are included in Section 2.5.

The original residential water supply survey conducted by AMETEK in the winter and spring of 1993, (Interim Measures for Nearby Private Wells Report, Groundwater Technology, Inc., April 26, 1993), revealed 34 residences with domestic supply wells within a one mile radius of the Site. Most residents granted access for routine sampling for chlorinated VOCs as part of the EPA approved IRM drinking water sampling program. Between 1993 and 2004, the number of residences included in the sampling program decreased to nine as residents accepted AMETEK's offer to connect to the local public water supply. As detailed in the RFI Addendum Report (reference detail in Section 5.0), groundwater sampling results from the nine residences included in the final IRM sampling events, conducted from April 2007 to March 2008, showed no detectable VOCs. As described in the RFI Addendum Report, the final sampling event of the Site's residential IRM groundwater sampling program was conducted on March 5, 2008.

Two residences (out of the nine residences remaining on the active sampling list) eventually accepted the offer to connect to the public drinking water supply, and by September 14, 2010, both residences, one in Sellersville Borough, and one in Perkasie Borough had been connected. The water supply connection work included the abandonment of the domestic supply well located at each residence. The remaining seven residences will not be sampled in the future.

1.2.3 RCRA Facility Investigation

1.2.3.1 Draft RFI Report (1997)

A RFI was performed at the Site pursuant to the agreements set forth in the Consent Decree agreed to by AMETEK and the EPA. The results of this RFI were previously presented to the EPA (Draft RCRA Facility Investigation, Groundwater Technology, Inc., dated February 24, 1997). The scope of the RFI activities included the characterization of groundwater, soil, surface water, and sediment, a soil gas survey, continuous groundwater level monitoring surveys and aquifer pump tests, and a Baseline Risk Assessment (BRA). The reader is referred to the Draft RFI report for further description of the areas-of-concern relative to COC sources to the groundwater media and the source locations (e.g., Former Dry Lagoons, Former Wet Lagoons)

Based on the characterization data collected and the results of the BRA, the primary potential exposure pathway was concluded to be the migration of VOCs from groundwater into down gradient off-Site residential wells.

As established during the Draft RFI the VOCs of concern in the groundwater media are the chlorinated VOCs cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dicholoretene(1,1-DCE), tetrachloroethene (PCE), TCA, and TCE. Collectively these compounds are referred to as the constituents of concern (COCs) for the Site. In addition to the defined COCs, the Site has also been monitored for 1,4-Dioxane, as described below. Based on the findings presented in the Draft RFI report and the EPA comments, additional characterization activities were conducted from 1999 through 2008 that are described below.

1.2.3.2 Additional Groundwater Investigation (1999 – 2008)

Various additional environmental investigation activities have been conducted at the AMETEK Site since the submittal of the Draft RFI report. Based on the results of the Draft RFI, Site investigation activities were focused on the primary media of concern, groundwater. The results were previously presented in the RCRA Facility Investigation Addendum and Final Letter Report on the Additional Environmental Investigation Activities Conducted in November 2007 (RFI Addendum report, dated June 2008, by Malcolm Pirnie, Inc.).

The following conclusions were developed regarding Site groundwater and local groundwater usage:

- Hydraulic control of the impacted groundwater at the Site is maintained via the Site's existing IRM groundwater extraction and treatment system;
- Beginning in August 2003, 1,4-Dioxane was added to the list of constituents sampled during the groundwater sampling events;
- Site groundwater with COC levels (e.g., chlorinated VOCs) above EPA Maximum Contaminant Levels (MCLs) and 1,4-Dioxane above the EPA's Tapwater Risk Based Screening Concentration of 6.1 micrograms per liter (ug/l), are largely confined to the Site property boundaries, and the Site groundwater monitoring wells;
- Remaining local residences served by domestic water supply wells (i.e., residences included in the completed IRM drinking water sampling program described above in Section 1.2.2.1) have been shown to be free of impacts by Site COCs during 12 sampling events conducted from 2003 to 2008;
- The closest known public water supply well, Perkasie Borough Authority (PBA) Well No. 10 (PBA-10), located approximately three

quarters of a mile northeast of the Site, was continuously operating by the PBA (see Section 2 for more details) during the 2003 to March of 2007 timeframe.

- While in operation (e.g., essentially throughout the RFI period), water provided by PBA-10 was treated with an air stripper to remove COCs prior to distribution. The location of PBA-10 is shown in Figure 1. It is likely that not all sources of the various reported constituents in water from well PBA-10 have been identified. This well was deactivated in March of 2007 and then re-activated in September 2012. PBA-10 is currently operating at lower groundwater withdraw amounts (versus the pre-March 2007 operation period) and not continuously 24-hours per day/7days per week versus the historical levels. Please refer to Section 2 for more details.
- A wellhead protection area (WHPA) has been established for the boroughs of Perkasie and Sellersville. Only the WHPA for the PBA-10 well contacts the Site boundaries (also displayed in Figure 1).
- Based on Perkasie Borough Ordinance 186-14 and according to the PBA, if public water is accessible to a residence within Perkasie Borough, then the PBA will not issue a permit for a private well. Presently, public water is available to all residents in PBA; therefore, no new private wells may be drilled.
- Technical Impractibilty (TI) relative to the groundwater media was presented to the EPA and a monitoring well network was established for future corrective actions at the Site. Details of the TI monitoring network are further discussed below and displayed in Figure 2.

1.2.3.3 RFI Approval RFI Addendum Report (June 2008)

In a letter dated May 14, 2009, the EPA approved the RFI (RFI Addendum report and BRA) for the Site.

Based on the data presented in the aforementioned reports, and the EPA's approval of the RFI phase of work, Site groundwater is the media of concern for continued environmental activities at the Site, and the focal point for the corrective measures described in the CMS report. Moreover, long term goals for Site groundwater, discussed in greater detail in subsequent sections of this report, are 1) the eventual attainment of MCLs of the VOC COC's beyond the property boundaries, and 2) the continued monitoring of 1,4-Dioxane levels in Site groundwater with respect to the aforementioned screening level.

1.2.4 Corrective Measures Study

The CMS report, dated January 28, 2011 was reviewed and the EPA commented on the CMS report via a letter dated March 31, 2011. The purpose of this CMS report was to evaluate potential final corrective actions for the Site and provide the final corrective action recommendation (i.e., corrective measure) for the Site media of concern (i.e., groundwater) for the subsequent Corrective Measure Implementation (CMI) phase of work as required by the Consent Order for the AMETEK Site. The CMS report describes the site conceptual model relative to the hydrogeological (e.g., aquifer zones, geologic cross sections) and VOC COC fate/transport mechanisms within the fracture bedrock structure beneath the Site. The reader is referred to Section 2.1 of this report for details on the bedrock units (i.e., Units 1 through 5) beneath the Site that are incorporated in the groundwater monitoring system for the Final Remedy.

Site and local groundwater exists in the bedrock beneath the Site. The bedrock is composed of a variety of inter-bedded sedimentary rocks that slope gently to the northwest. Site bedrock is typically covered by a thin veneer of soil that is generally less than 10 feet thick.

Groundwater occurs in fractures and bedding planes in bedrock; these openings are known as zones of secondary porosity. Under non-pumping conditions, groundwater beneath the Site, approximately 30-40 feet below ground surface (bgs), can be expected to flow in a northerly direction; a direction roughly commensurate with the direction of the slope of the bedrock (known as the bedrock dip direction), and the slope of the landscape (i.e., toward the East

Branch of the Perkiomen Creek). However, the investigative work completed to date has revealed that groundwater flow, and hence Site COC distribution, has also followed an easterly course over time (i.e., a direction closely aligned with the strike of the local bedrock strike – bedrock strike being the direction perpendicular to bedrock dip). This distribution is believed to be a manifestation of the historic pumping activities that occurred in areas located to the east and northeast of the site (e.g., the public supply well, PBA-10, described previously).

The CMS report summarized groundwater quality data collected through calendar year 2010. Section 2 of this report provides the results of the groundwater monitoring data conducted in 2011 and 2012.

1.2.4.1 Corrective Measures Objectives

Corrective measures objectives (CMOs) are the narrative statements of specific goals that are necessary to protect human health and the environment. These CMOs provided a basis for evaluating the effectiveness of the remedial alternative selected for the CMI phase. The following CMOs were identified for the COCs and 1,4-Dioxane in Site groundwater:

1. Reduction of COC concentrations in groundwater to MCLs within the proposed network of Site monitoring wells, described above as the Site's TI boundary monitoring well network, and including monitoring wells MW-21S and MW-21D (new)); and

2. Ongoing groundwater monitoring to demonstrate the reduction of reported 1,4-Dioxane concentrations within the Site's proposed TI Boundary monitoring well network (as described above) and MW-22D. The EPA's Tapwater Risk Based Screening Concentration for 1,4-Dioxane of 6.1 µg/l will serve as a reference point for the evaluation of reported 1,4-Dioxane concentrations in groundwater. This 1,4-Dioxane screening level will also function as an evaluation item for decisions on changes to groundwater monitoring procedures and/or groundwater recovery operations through the Site's IRM groundwater recovery and treatment system.

These objectives are intended to be protective of human health and the environment, and the potential groundwater receptors discussed in the BRA.

1.2.4.2 TI Boundary

As described in the RFI Addendum report, the Site's TI Boundary monitoring wells (i.e., the 17 monitoring wells selected for periodic TI compliance groundwater elevation gauging and COC sampling) are listed in the table below and shown on Figure 2.

The TI Boundary has been defined as the Site property boundary. The monitoring wells proposed for TI compliance monitoring are those with open borehole intervals located above bedrock Unit 2 in the "northern" Site area, and monitoring wells with open borehole intervals in and/or above Unit 3 in the "southern" Site area. The TI boundary, or TI Zone, is a three dimensional framework (i.e., box) within which;

1. Hydraulic control will be maintained through operation of the Site's existing groundwater recovery and treatment system,

2. Hydraulic control will be monitored though gauging of the Site's TI Boundary monitoring wells (and the comparison of potentiometric data from these monitoring events to a database of historic measurements), and

3. Groundwater COC stability will be monitored with respect to MCLs for COCs, and concentrations of 1,4-Dioxane will be recorded and evaluated with respect to the EPA's Tapwater Risk Based Screening Concentration of 6.1 ug/l, for indications of concentration or distribution instability (i.e., within the TI monitoring well network described below).

Monitoring Well	Site Area	Site Bedrock Unit(s)	Proposed COC for TI Compliance Sampling	Basis
MW-5S	Southern	Unit 1 and upper portion of Unit 2	VOCs and 1,4-Dioxane	Near property line monitoring well cluster located along bedrock strike (i.e., northeast) of the Former Dry Lagoon Area. The wells are included in the Site's TI boundary monitoring
MW-5D (new)	Southern	Portion of Unit 2, Unit 3 (water bearing zone), and upper portion of Unit 4	VOCs and 1,4-Dioxane	Selected based on COC trends to date in both wells (MW-5D (new) and MW-5S), to monitor COC stability in response to the deactivation of public supply well PBA-10, and the replacement (i.e. abandonment) of MW-5D by MW-5D (new) in March 2005. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs and monitoring of 1,4-Dioxane.
MW-7S	Southern	Unit 1 and a portion of Unit 2	VOCs and 1,4-Dioxane	As requested by the EPA, MW-7S is included as an "internal" Site TI monitoring well to evaluate COC stability downgradient of the Former Dry Lagoon Area. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs and monitoring of 1,4-Dioxane.
MW-19D	Southern	Unit 3 and a portion of Unit 4	VOCs and 1,4-Dioxane	A deep aquifer zone well located northeast of the Site property boundary and approximately along bedrock strike with the southern end of the Former Dry Lagoon Area. MW-19D is well suited to monitor southern deep aquifer COC levels in response to the deactivation (or activation) of public supply well PBA-10 (i.e., beyond MW-5D (new)). Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs and monitoring of 1,4-Dioxane.

Monitoring Well	Site Area	Site Bedrock Unit(s)	Proposed COC for TI Compliance Sampling	Basis
MW-24S	Southern	Unit 1 and a portion of Unit 2	VOCs and 1,4-Dioxane	A property line shallow aquifer zone monitoring well, MW-24S is well suited to monitor COC stability in an along strike orientation from MW-5S. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs and monitoring of 1,4-Dioxane.
MW-11S and	Northern	1	VOCs and 1,4-Dioxane	Site property line monitoring well cluster located in the approximate down (bedrock)-dip direction of the existing groundwater recovery and treatment system, and the potential northern Site constituent source areas described in the RFI Addendum report. Continued sampling/gauging necessary to monitor COC stability in response to groundwater treatment system pumping. Groundwater levels in the well cluster indicate a downward flow potential (i.e., opposite most other well clusters in the immediate vicinity). Long-term COC stability (i.e., less than MCLs) observed in adjacent (i.e., down-dip) MW-16S. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs.
MW-11D	Northern	Middle to lower portion of Unit1	VOCs	

Monitoring Well	Site Area	Site Bedrock Unit(s)	Proposed COC for TI Compliance Sampling	Basis
MW-12S	Northern	1	VOCs and 1,4-Dioxane	Property line monitoring well cluster located in the approximate down-dip direction of the existing groundwater recovery and treatment system and the potential northern Site constituent source areas discussed in the RFI Addendum report. Continued sampling necessary to monitor COC stability in response to groundwater treatment system pumping. Long-term COC stability (i.e., concentrations less than MCLs) observed in adjacent (i.e., down-dip) MW-16S, and the MW-17S/MW-17D well cluster. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs.
MW-12D	Northern	Middle to lower portion of Unit 1	VOCs	
MW-15S and	Northern	1	VOCs and 1,4-Dioxane	Property line monitoring well cluster located in the approximate along (bedrock) strike position with respect to the northern potential constituent Site areas described in the RFI Addendum report. Long-term COC stability (i.e., concentrations less than MCLs) observed in adjacent (i.e., along strike) MW-18S. MW-15S/MW-15D (new) are well suited to observe long-term COC concentration changes (if any) in response to the deactivation of local public supply well PBA-10. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs and monitoring of 1,4-Dioxane.
MW-15D (new)	Northern	Bottom of Unit 1 and upper portion of Unit 2	VOCs and 1,4-Dioxane	

Monitoring Well	Site Area	Site Bedrock Unit(s)	Proposed COC for TI Compliance Sampling	Basis
MW-16S	Northern	1	VOCs	Shallow aquifer zone (SAZ) monitoring well located north of the property line, added to the TI boundary monitoring well network as discussed with the EPA . Continued sampling necessary to monitor COC stability in response to existing groundwater recovery and treatment system pumping. Long-term COC stability (i.e. concentrations less than MCLs) has been observed in this well. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs.
MW-17S and MW-17D	Northern	1	VOCs	Monitoring well cluster located in a key position (i.e., down-dip and along strike) with respect to the aforementioned well clusters. Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs.
	Northern	Middle to lower portion of Unit 1	VOCs	
MW-18S	Northern	1	VOCs	SAZ monitoring well located along bedrock strike with respect to deactivated public supply well PBA-10 and adjacent monitoring well cluster MW-15S/MW-15D (new). Proposed COC for TI monitoring based on long-term COC concentration trends with respect to MCLs.
MW-20S	Northern	1	VOCs	Near property line monitoring well cluster located approximately along bedrock strike and southwest of the Former Wet Lagoon Area (i.e., the potential northern Site constituent source areas discussed in the RFI Addendum report) and groundwater recovery well RW-1. Groundwater elevations indicative of an upward flow potential, and the variety of COC in both wells, warrants the list of COC for TI boundary monitoring events.
and MW-20D	Northern	Bottom of Unit 1	VOCs and 1,4-Dioxane	

1.2.4.3 CMS RECOMMENDATIONS

The CMS Report evaluated five different corrective action alternatives to reduce COC concentrations in groundwater. However, the hydrogeological conditions at the Site potentially preclude the feasibility of remediating Site groundwater via any of these alternatives to the Consent Order specified Groundwater Protection Standards (e.g., MCLs). Therefore, the proposed remedial approach for completing Site groundwater corrective measures with controls is through the continued operation and monitoring of the Site's existing IRM groundwater extraction and treatment system, and through long-term groundwater COC stability monitoring. The long-term monitoring of hydraulic control within the Site's TI Boundary (i.e., confirmation of the prevention of off-Site migration), as well as the reduction in COC to groundwater cleanup objectives in wells beyond the Site's TI Zone is proposed through performance sampling and gauging of the proposed TI Boundary monitoring well network, and monitoring wells MW-21S, MW-21D (new) and MW-22D, as described previously and in Section 2.

1.2.4.4 Proposed Land Use/ Development Restrictions

The area of the Site within the TI Boundary/TI Zone, and its supporting network of monitoring wells, will be subject to land use and development restrictions with regard to Site groundwater constituents. These restrictions will be in place during the time needed to reduce groundwater COC to MCLs, and monitor for 1,4-Dioxane against the EPA's Tapwater Risk Based Screening Concentration, via the continued operation of the Site's existing groundwater recovery and treatment system (i.e., engineering controls as discussed in subsequent sections of this report), and the related annual TI compliance sampling activities described in Section 2. Site land use/development restrictions will be related to Site groundwater.

An environmental covenant for the Site area defined by the TI Boundary and the entire AMETEK Sellersville property parcel will be prepared as defined under the Pennsylvania Uniform Environmental Covenants Act

(UECA-Act 68). The purpose of the environmental covenants will be to memorialize the future disposition of the property with regard to the groundwater and related engineering/institutional controls described herein. Additional explicit land use restrictions, including possible requirements for vapor mitigation systems for future construction (i.e., in the event future commercial use of the Site is considered), will be specified in the Pennsylvania UECA.

1.3 Final Remedy

On August 23, 2011, the EPA issued the Statement of Basis (SB) report describing the Agency's proposed remedy and soliciting public comments on the proposal. After review of the public comments, the EPA concluded that no modifications of the proposed remedy were necessary. The remedy in the SB report was selected as the Final Remedy on June 8, 2012.

The EPA selected the following corrective measures to control groundwater impact at the Site to be fully protective of human health and the environment:

- TI Zone
- Groundwater Pump and Treat
- Long Term Groundwater Monitoring for Containment Stability and Hydraulic Control
- Institutional Controls (Environmental Covenant)

Refer to the EPA document "Final Decision and Response to Comments on Selection of Corrective Measures Under 3008(h) of the Resource Conservation Recovery Act, AMETEK, U.S. Gauge Division- Plant # 2, Sellersville, Pennsylvania, dated June 8, 2012" for additional details. These corrective measures are further defined in Sections 3 and 4 of this report.

1.4 Report Organization

This CMI report is organized as follows:

- Section 1: Introduction – Defines the purpose of the CMI as the foundation for the Final Remedy for the Site. It presents a summary of historical Site investigations and characterization reports completed to date.
- Section 2: Description of the Current Groundwater Situation - Using groundwater media data presented in the CMS report, this section updates the groundwater database for the Site with results of groundwater sampling activities conducted in 2011 and 2012.
- Section 3: Selected Remedy- this section defines the components of the corrective actions for the Final Remedy, and the groundwater monitoring program.
- Section 4: Reporting Requirements– this section defines the reporting requirements for the Annual report and potential intermediate reporting that would be necessary.
- Section 5: References specified in this report.

2.0 CURRENT GROUNDWATER SITE CONDITIONS

The existing site groundwater conditions are represented within this section of the CMI report. These existing conditions are monitored and reported to the EPA based on the previously established Site TI Boundary and the agreed upon periodic TI groundwater monitoring program (refer to Section 5.1 of the CMS report for further detail). The existing groundwater conditions described within this section are a result of two groundwater gauging/sampling events. The first periodic sampling event was conducted in March of 2011 and the second event occurred during April of 2012. These events were conducted after the submission of the CMS report to the EPA.

In order to interpret and understand the results of the periodic sampling events, the Site TI Boundary (Section 1.2.3.2, above), the Site Conceptual Model (SCM) should first be reviewed. A detailed description of the SCM is presented within the CMS Report and the RFI Addendum Report, please refer to these previously submitted documents for greater detail on the SCM. An abridged version of the SCM description is provided in Section 2.1 below.

2.1 Site Conceptual Model

The SCM describes the distribution, extent, fate and transport of the Site's groundwater COC (e.g., chlorinated VOCs) and 1,4-Dioxane in the context of the stratigraphy and structure of the local bedrock aquifer system.

The Site is located in the Triassic Lowlands Section of the Piedmont Physiographic Province of southeastern Pennsylvania. Bedrock in the vicinity of the Site consists of sedimentary rocks of the Triassic Newark Group. Bedrock beneath the Site consists of soft red to reddish brown siltstones, shale and fine grained sandstone interbedded with gray to almost black units of shale and argillite. Published Site investigation reports and available literature indicate that these inter-fingered sequences of reddish and grayish sedimentary rocks comprise the Brunswick Formation and Lockatong Formation.

Groundwater occurs primarily within zones of secondary porosity, and near the land surface, generally occurs under water table conditions. Semi-confined to confined aquifer conditions begin to dominate at greater depths where a general reduction in the connections between stratigraphically-bound water-bearing zones occurs. The likely groundwater recharge area for Site groundwater is to the southeast of the Site.

The current groundwater flow directions and constituent distribution in the shallow and deep aquifer zones are on the largest scales a function of the northwesterly dipping, interbedded units of the Brunswick and Locakatong formations, and on smaller scales the result of various high-angle joint systems. The Lockatong lithofacies unit appears to serve as a confining bed between the shallow and deep aquifer zones beneath the southern portion of the Site, but due to regional dip, lies beneath all but the deepest deep aquifer zone monitoring wells in the northern Site area.

As presented in the RFI Addendum report, and in prior groundwater characterization reports submitted from 2003 to 2011, analytical results for VOCs and 1,4-Dioxane are presented separately for the Site's Shallow Aquifer Zone (SAZ) monitoring wells (entire Site), Northern Deep Aquifer Zone (NDAZ) monitoring wells, and Southern Deep Aquifer Zone (SDAZ) monitoring wells. These subdivisions by aquifer zone and Site area reflect the SCM, with respect to Site hydrogeology and stratigraphy, as previously defined. Specifically, SAZ monitoring wells are located within Brunswick Formation rocks, defined extensively in the RFI Addendum Report as Unit 1.

NDAZ monitoring wells are also located within Unit 1 but at greater depths (i.e., generally close to the base of Unit 1; near the contact with Unit 1 and underlying Lockatong lithofacies rocks defined previously as Unit 2). Groundwater generally occurs under water table aquifer conditions and semi-confined conditions in the Site-wide SAZ and NDAZ, respectively. Figure 3 displays a geologic cross-section location across the Site and Figure 4 shows the subsurface geologic relationships between the Site's SAZ monitoring wells, NDAZ monitoring wells, and SDAZ monitoring wells.

The SDAZ monitoring wells have been constructed with open borehole intervals below Unit 2. As described in the RFI Addendum report, Unit 2 is a confining bed, and as such there is a marked difference (e.g., up to 70 feet) in groundwater elevations, and a related downward groundwater flow potential, between the SAZ and the underlying SDAZ.

Cross section A to A', as well as the geologic cross sections included in the RFI Addendum Report, display the interbedded Brunswick Formation and Lockatong lithofacies rocks beneath the Site, as well as a number monitoring wells within the Site's current groundwater monitoring network. As shown on the cross sections, and as defined in the RFI Addendum Report and prior reports, individual rock units are designated as Unit 1 (generally soft, reddish-brown Brunswick Formation siltstones, shales and fine-grained sandstones), Unit 2 (Lockatong lithofacies rocks, generally grayish shale and hard gray to black argillite), Unit 3 (reddish sedimentary rocks similar to Unit 1), Unit 4 (gray to black rocks similar to Unit 2), and Unit 5 (rocks similar to Units 1 and 3).

The above described SCM, the Site TI Boundary, and the monitoring wells that lie within the TI Boundary (listed within Section 1.2.3.2) are the foundation for the periodic TI groundwater monitoring program.

2.2 Discussion of Site Annual TI Groundwater Compliance Sampling

The Site's TI Boundary monitoring well network is comprised of seventeen (17) monitoring wells (see Figure 2). In addition, three monitoring wells, MW-21S, MW-21D (new), and MW- 22D that are outside the TI Boundary and are not part of the TI monitoring well network but are part of the monitoring program.

The basis for inclusion of each of the 17 TI Boundary monitoring wells and three sentinel wells is explained in detail in the CMS report.

The goal of the long term remedy for the COCs in MW-21S and MW-21D (new) groundwater is to reduce concentrations to respective MCLs through the IRM groundwater pump and treat system. Monitoring wells MW-21S and MW-21D (new) will be gauged and sampled during future TI Boundary monitoring well gauging and sampling events. If increasing COC concentration trends are observed in MW-21S and MW-21D (new), further evaluation may be needed for localized groundwater remediation for specific COCs.

Monitoring well MW-22D is also outside the TI Boundary, and is not part of the TI monitoring well network. The 1,4-Dioxane levels in MW-22D have been above the EPA's 1,4-Dioxane Screening Concentration of 6.1 ug/l periodically since 2003. MW-22D was not analyzed for 1,4-Dioxane during the 2007 and 2008 groundwater sampling events. However, in March 2010, MW-22D was added to the list of groundwater monitoring wells to be sampled for 1,4-Dioxane in future groundwater sampling events.

During the March 2011 and April 2012 groundwater sampling events, 1,4-Dioxane was reported at a concentration of 3.0 ug/L and 0.33 ug/L in MW-22D. As such, MW-22D will be sampled for 1,4-Dioxane during future TI Boundary monitoring well gauging and sampling events, and will be evaluated against the Screening Concentration. Decisions on changes to groundwater monitoring procedures and/or Site groundwater recovery and treatment operations will be based on this evaluation. The TI Boundary monitoring well network will be reevaluated over time, and recommendations on refining the network will be made based on an annual evaluation of future monitoring results.

The annual groundwater sampling events of March 2011 and April 2012 were conducted as part of the agreed upon annual TI compliance sampling that was established within the CMS report, subsequent correspondence with the EPA, and prior to the EPA Final Remedy. These two annual groundwater sampling events were conducted to continue the verification and evaluation of constituent stability and distribution within the Site's TI boundary network and the nature of groundwater flow and control at the Site. A discussion of the results from these sampling events is included below.

As shown on Table 5, groundwater elevations higher than the proposed maximum groundwater elevations for the CMS Phase (Final CMS report, Table 3) were reported during the March 2011 event.

These increased groundwater elevations coincide with the time frame during which the PBA-10, water supply well was inoperable. PBA-10 is the closest known public water supply well and is located approximately three quarters of a mile northeast of the Site. All but one of the groundwater elevations shown for the deep aquifer monitoring wells on Table 5 is higher than the proposed maximum groundwater elevations for the CMS Phase.

Table 6 shows the groundwater elevations for April 2012. All of the groundwater elevations shown for both the shallow and deep aquifer monitoring wells on Table 6 are lower than the proposed maximum groundwater elevations for the CMS Phase.

Well PBA-10 was deactivated by the PBA on March 23, 2007 and since reactivated on September 9, 2011 at 9:15 AM. Langan confirmed with the PBA that this was that the well has be operational since September 9, 2011. The PBA informed Langan that the daily operation of PBA-10 will vary in duration and pumping rate, but PBA-10 will pump groundwater for an average of 6-hours per day generating approximately 100,000 gal/day. On a quarterly basis, the PBA has agreed to provide Langan data the PBA collects in relation to PBA-10.

Based upon these observed natural groundwater level fluctuations and the reactivation of PBA-10, the previously recommended Site hydraulic control criteria from the CMS Report may no longer be applicable. As such, performance criteria will continue to be monitored through synoptic gauging on a monthly basis, evaluation of quarterly PBA-10 data and groundwater extraction and treatment system performance monitoring to ensure that Site hydraulic control is being maintained. See Sections 2.3 and 4.1 for a more detailed discussion

2.2.1 Scope of the Site Groundwater Sampling Events Conducted in March 2011 and April 2012

Site groundwater sampling events were conducted from March 28 to March 30, 2011 (March 2011 event), and from April 18 to April 20, 2012 (April 2012 event). Both the March 2011 event and the April 2012 event included the 17 Site TI Boundary monitoring wells and the three sentinel wells (list of wells included in Section 1.2.3.2., above). As part of the groundwater sampling events, synoptic water levels are to be obtained from all of the site groundwater monitoring wells (and the stream gauges on the East Branch Perkiomen Creek) for evaluation. The sampling protocol and quality assurance/control measures were completed in accordance to the quality assurance/control protocols presented in the Revised Work Plan (June 21, 1993).

The following groundwater sampling approach was employed during the March 2011 event:

- Sampling of the 20 monitoring wells in March 2011 for Target Compound List (TCL) VOCs via EPA Method OLC 02.1, including; 11 shallow wells and nine deep aquifer zone wells.
- Sampling of 11 wells in March 2011 for 1,4-Dioxane via EPA Method 1624m. The March 2011 event included six shallow wells and five deep wells. The March 2011 event included sampling MW-22D for 1,4-Dioxane.
- VOC and 1,4-Dioxane sample results for the March 2011 event are shown in Tables 1 and 2 and in Figure 5, (Shallow Aquifer Zone), Figure 6 (Southern Area Deep Aquifer Zone), and Figure 7 (Northern Deep Aquifer Zone). Laboratory analytical reports for the groundwater samples collected during the March 2011 event, the results of which are discussed below, are included on the enclosed CD and Appendix A.
- As authorized by the EPA (EPA's approval email dated February 15, 2005), a 10% random validation of the March 2011 VOC and 1,4-Dioxane groundwater data was conducted. To provide a random selection of laboratory results for validation, sampled wells were assigned a number from one to 20). Using these number sets, the "RANDOM" function of

Microsoft Excel was then run ten times to generate two evenly distributed random real numbers. Laboratory reports for the corresponding well numbers selected by this method were subsequently validated in accordance with established data validation procedures. Data validation reports are included in Appendix B.

The following groundwater sampling approach was employed during the April 2012 event:

- Sampling of the 20 TI Boundary monitoring wells in April 2012 for Target Compound List (TCL) VOCs via EPA Method SOM01.2 Trace Volatiles, including; 11 shallow wells and nine deep aquifer zone wells.
- Sampling of 11 wells for 1,4-Dioxane in April 2012 via EPA Method 522. The April 2012 event included six shallow wells and five deep aquifer zone wells. The April 2012 event included sampling MW-22D for 1,4-Dioxane.
- Since the 2011 annual groundwater sampling event Test America (laboratory used for analytical testing) upgraded their Low Level Water Volatile Organic Compounds (VOC) by GC/MS method from Contract Laboratory Program (CLP) OLC02.1 method to SOM01.2 Trace Volatiles. In SOM01.2, 1,4-Dioxane is no longer a target analyte by Trace VOC and Trace VOC SIM analyses. Due to poor purge efficiency, using SOM01.2 for the detection and reporting of 1,4-Dioxane at low and medium levels has not consistently generated data of sufficiently known quality. In order to meet the data quality objects for the analysis of 1,4-Dioxane, Method 522 was selected. In addition, Test America consolidated their CLP laboratories to one facility located at South Burlington, Vermont.
- VOC and 1,4-Dioxane sample results for the April 2012 event are shown in Tables 3 and 4 and in Figure 6, (Shallow Aquifer Zone), Figure 7 (Southern Area Deep Aquifer Zone), and Figure 8 (Northern Deep Aquifer Zone). Laboratory analytical reports for the groundwater samples collected during the April 2012 event, the results of which are discussed below, are included on the enclosed CD and Appendix A.
- As authorized by the EPA (EPA's approval email dated February 15, 2005), a 10% random validation of the April 2012 VOC and 1,4-Dioxane

groundwater data was conducted. To provide a random selection of laboratory results for validation, sampled wells were assigned a number from one to 20). Using these number sets, the "RANDOM" function of Microsoft Excel was then run ten times to generate two evenly distributed random real numbers. Laboratory reports for the corresponding well numbers selected by this method were subsequently validated in accordance with established data validation procedures. Data validation reports are included in Appendix B.

2.2.1.1 Water Level Measurements

Synoptic rounds of groundwater-level measurements were completed on March 28, 2011 and April 18, 2012. These events included all accessible on- and off-Site monitoring wells that include the TI Boundary monitoring wells. A total of 40 monitoring wells were gauged in March 2011 and 38 monitoring wells were gauged in April 2012. Measurements were made using a SolinstTM electronic water-level meter, and water-level data were converted from depth values (i.e., from well top-of-casing) to elevation values relative to mean sea level (MSL). Depth-to-water measurements and resulting groundwater elevations are presented in Tables 5 and 6. Potentiometric surface maps generated as a result of measured shallow and deep aquifer zone groundwater levels are discussed in Section 2.3.

2.2.1.2 Low Flow Groundwater Sampling

During the March 2011 and April 2012 sampling events, groundwater sampling was conducted in a manner consistent with the EPA approved Work Plan (Revised Work Plan report), the April 27, 1999 letter (prepared previously by the IT Corporation), and the December 6, 2002 Low-flow Purge Groundwater Sampling Letter submitted by Malcolm Pirnie. During the March 2011 groundwater sampling event, sampling purge water (approximately 100 gallons during each of the sampling events) was discharged to the Pennridge Water Treatment Authority (PWTA) via the on-Site manhole located at the entrance to the facility. Based on the cessation of operations at the Site in 2012, the PWTA's Industrial

Pretreatment Program Class II Industrial Wastewater Contribution Permit for this facility, No.09-02, issued on September 3, 2009, was terminated on April 24, 2012. During the April 2012 groundwater sampling event, purged groundwater was sent to the treatment system for treatment and discharged, instead of the sanitary sewer.

Each groundwater sample was collected using a two-inch Grundfos stainless steel submersible pump and dedicated polyethylene tubing. Sampling logs were maintained for each monitoring well and included well data, start/stop time for purging, water appearance (as necessary), and regular five-minute measurements of field indicator parameters, including pH, specific conductivity, turbidity, dissolved oxygen, temperature, salinity, oxidation/reduction potential, purge rate and depth to water (see Appendix C). Groundwater samples were collected after selected water quality parameters equilibrated, which is defined by the low purge sampling methodology as three successive readings with parameters meeting the following requirements:

- pH within +/- 0.1;
- Specific conductivity within +/- 3%;
- Dissolved oxygen and turbidity within +/- 10% of each reading; and
- Oxidation-reduction potential within +/- 10 millivolts.

Monitoring well purge rate was attempted at 1 liters per minute (L/min); however, the actual purge rate employed was dependent on well yield (and observed drawdown in each well), and in many wells was closer to 0.5 L/min. Additionally, shallow aquifer zone wells were sampled prior to the deep zone wells to minimize hydraulic influence, if any, between shallow and deep wells within a given monitoring well cluster.

Groundwater samples were collected at the middle horizon of the saturated zone within the open borehole of each monitoring well using the submersible pump mentioned above, and at a rate of 0.1 L/min or less. As required by the EPA-approved Revised Work Plan, QA/QC samples were also collected to evaluate sample data quality and validity. QA/QC samples consisted of field blanks, rinsate blanks, trip blanks, matrix spike and matrix spike duplicates, and blind duplicates.

2.2.2 March 2011 Site Groundwater Sampling Event Findings and Discussion

A total of 20 monitoring wells were sampled for the March 2011 event including 11 shallow wells and nine deep wells as listed below:

- Shallow Aquifer Zone (SAZ) wells included MW-5S, MW-7S, MW-11S, MW-12S, MW-15S, MW-16S, MW-17S, MW-18S, MW-19S, MW-20S and MW-21S.
- Southern Area Deep Aquifer Zone (SDAZ) wells included MW-5D and MW-19D.
- Northern Area Deep Aquifer Zone (NDAZ) wells included MW-11D, MW-12D, MW-15D (new), MW-17D, MW-20D, MW-21D and MW-22D.

2.2.2.1 March 2011 Shallow Aquifer Zone Wells – Low-Flow Groundwater Sampling Results

Generally, and as shown on Figure 5, the COC constituents detected in the SAZ wells during the March 2011 sampling event were similar as those detected since January of 2003. The following COC concentration observations are noted below.

The highest SAZ COC constituent concentrations for the March 2011 event were reported in the sample collected from MW-5S, located northeast of the Former Dry Lagoon (refer to the CMS report for the location). It should be noted that the elevated COC concentration detected in MW-5S may be attributed to the deactivation of the PBA-10 well and its influence on Site groundwater during the March 2011 event. Figure 5 shows the distribution of COCs in the shallow wells for the March 2011 sampling event. The most frequently detected COCs in the shallow aquifer zone were cis-1,2-DCE and TCE, which were each detected in 8 of the 11 shallow wells sampled for the March 2011 event.

Other commonly detected COCs included: 1,1-DCE (five detections), 1,1,1-TCA (five detections), and PCE (three detections).

TCE in Shallow Wells for the March 2011 Event

As shown on Figure 5, the highest TCE detection was found in the sample from MW-5S, at a concentration of 4,200 μg/L. Monitoring well MW-5S is located northeast of the Former Dry Lagoon. TCE concentrations in all other shallow wells sampled were at least an order of magnitude lower than levels reported in MW-5S. The next highest detections of TCE were reported in the samples from MW-7S and MW-11S, at concentrations of 630 μg/L and 220 μg/L, respectively. Monitoring well MW-7S is located near the northern edge of the Former Dry Lagoon and MW-11S is located in the vicinity of the Former Wet Lagoon area (refer to the CMS report for the location).

PCE in Shallow Wells for the March 2011 Event

The highest PCE detection, 85 μg/L, was found in the sample from MW-7S. Like TCE, PCE concentrations in all shallow wells sampled were at least an order of magnitude lower than levels reported in MW-7S. The only other detections of PCE were reported in samples from MW-12S and MW-20S, at concentrations of 2.0 μg/L and 3.1 μg/L, respectively.

Cis-1,2-DCE in Shallow Wells for the March 2011 Event

The highest cis-1,2-DCE detection, 3,700 μg/L, was found in the sample from MW-5S. Concentrations were significantly lower in the other shallow wells sampled. The next highest detections of cis-1,2-DCE were 620 μg/L in MW-11S and 120 μg/L in MW-7S.

1,1,1-TCA in Shallow Wells for the March 2011 Event

The highest 1,1,1-TCA detection, 260 μg/L, was found in the sample from MW-5S. Concentrations were significantly lower in all other shallow wells sampled except for MW-11S which had a detection of 210 μg/L.

1,1-DCE in Shallow Wells for the March 2011 Event

The highest 1,1-DCE detection, 310 µg/L was found in the sample from MW-5S. The next highest detections of 1,1-DCE were 180 µg/L in MW-11S and 91 µg/L in MW-15S.

2.2.2.2 March 2011 Deep Aquifer Zone Wells – Low-Flow Groundwater Sampling Results

Generally, and as shown on Figures 6 and 7, the COC constituents detected in the SDAZ and NDAZ wells during the March 2011 sampling event were the same as those detected since January of 2003. The following COC concentration observations are noted:

<u>SDAZ Wells</u>

As displayed on Figure 6, the COC constituents detected in the SDAZ are generally the same as those detected during previous groundwater sampling events since January of 2003.

All of the SDAZ COC detectable concentrations were reported in the sample collected from MW-5D as the sample collected from MW-19D contained no detectable concentrations of COCs. COCs detected in MW-5D for the March 2011 event were cis-1,2-DCE and TCE.

Figure 6 shows the distribution of COCs in the SDAZ wells for the March 2011 sampling event. Similar to the reported constituent results shown on Figures 4A, 4B and 4C in the CMS report, SDAZ constituents with reported concentrations above the EPA MCLs or IRA level during the March 2011 sampling event are shown in highlighted cells on Figure 6.

<u>Cis-1,2-DCE in SDAZ Wells for the March 2011 Event</u>

The constituent cis-1,2-DCE was reported at 14 µg/L in MW-5D and was not detected within the sample from MW-19D.

<u>TCE in SDAZ Wells for the March 2011 Event</u>

The constituent TCE was reported at 2.9 µg/L in MW-5D and was not detected within the sample from MW-19D.

NDAZ Wells

Generally, and as shown on Figure 7, the COC constituents detected in the NDAZ were the same as those detected during all previous groundwater sampling events since January of 2003 with the exception of MW-15D (new).

The highest NDAZ COC concentrations were reported in the sample collected from MW-15D. The most frequently detected COCs in the NDAZ wells was cis-1,2-DCE and TCE which were detected in four of the six wells sampled. Other frequently detected COCs included 1,1-DCE and PCE, which were detected in two and three of the six wells sampled, respectively. Concentrations of constituents detected above EPA MCLs during the March 2011 groundwater sampling events are also highlighted on Figure 7.

Cis-1,2-DCE in NDAZ Wells for the March 2011 Event

The highest cis-1,2-DCE detection in the NDAZ was reported in the sample from MW-20D at a concentration of 100 µg/L. Monitoring well MW-20D is located immediately north of the Former Wet Lagoon and west of MW-10D, roughly parallel to bedrock strike.

TCE in NDAZ Wells for the March 2011 Event

The highest TCE detection in the NDAZ was reported in the sample from MW-15D (new) at a concentration of 240 µg/L. The next highest reported concentration was found in MW-20D at a concentration of 63 µg/L.

PCE in NDAZ Wells for the March 2011 Event

The highest NDAZ detection of PCE was reported in the sample from MW-15D (new) at a concentration of 40 µg/L.

1,1-DCE in NDAZ Wells for the March 2011 Event

The COC 1,1-DCE was reported in two of the samples at a detection of 16 μg/L and 2.6 μg/L in MW-20D and MW-17D, respectively.

2.2.2.3 March 2011 1,4-Dioxane Sampling Results

Groundwater samples from 11 monitoring wells were analyzed for 1,4-Dioxane via Method 1624m.

SAZ Wells

The constituent 1,4-Dioxane was detected in all six of the SAZ wells sampled. The highest 1,4-Dioxane detection, 182 μg/L was found in the sample from MW-5S. The next highest detections of 1,4-Dioxane were 165 μg/L in both MW-11S and MW-15S.

Deep Aquifer Zone Wells

SDAZ Wells

The constituent 1,4-Dioxane was detected in both SDAZ monitoring wells sampled during the March 2011 event. As shown on Figure 6, concentrations ranged from 1.7 μg/L to 1.0 μg/L in the samples from MW-5D and MW-19D, respectively.

NDAZ Wells

The constituent 1,4-Dioxane was detected in all three of the NDAZ monitoring wells sampled during the March 2011 event: MW-15D, MW-20D and MW-22D. Reported concentrations ranged from 7.0 μg/L in MW-15D to 3.0 μg/L in MW-22D.

2.2.3 April 2012 Site Groundwater Sampling Event Findings and Discussion

A total of 20 monitoring wells were sampled for the April 2012 event including 11 shallow wells and nine deep wells as listed below:

- Shallow Aquifer Zone (SAZ) wells included MW-5S, MW-7S, MW-11S, MW-12S, MW-15S, MW-16S, MW-17S, MW-18S, MW-19S, MW-20S and MW-21S.
- Southern Area Deep Aquifer Zone (SDAZ) wells included MW-5D and MW-19D.
- Northern Area Deep Aquifer Zone (NDAZ) wells included MW-11D, MW-12D, MW-15D (new), MW-17D, MW-20D, MW-21D and MW-22D.

2.2.3.1 April 2012 Shallow Aquifer Zone Wells – Low-Flow Groundwater Sampling Results

Generally, and as shown on Figure 5, the COC constituents detected in the SAZ wells during the April 2012 sampling event were the same as those detected since January of 2003. The following COC concentration observations are noted below.

The highest SAZ COC constituent concentrations for the April 2012 event were reported in the sample collected from MW-5S, located northeast of the Former Dry Lagoon. It should be noted that there has been an increase in the concentrations for all COCs in groundwater samples collected from MW-24S between March 2011 and April 2012.
Figure 5 shows the distribution of COCs in the shallow wells for the April 2012 sampling event. The most frequently detected COCs in the shallow aquifer zone was TCE which was detected in all of the 11 shallow wells sampled for the April 2012 event. Other commonly detected COCs included: cis-1,2-DCE (nine detections) and PCE (nine detections), 1,1-DCE (eight detections), and 1,1,1-TCA (eight detections).

<u>TCE in Shallow Wells for the April 2012 Event</u>

As shown on Figure 5, the highest TCE detection was found in the sample from MW-5S, at a concentration of 4,900 D µg/L (the "D" indicates analysis of a diluted sample). Monitoring well MW-5S is located northeast of the Former Dry Lagoon. The next highest detection of TCE was reported in the sample from MW-7S, at a concentration of 1,300 µg/L D. Monitoring well MW-7S is located near the northern edge of the Former Dry Lagoon. TCE concentrations in all other shallow wells sampled were at least an order of magnitude lower than levels reported in MW-5S and MW-7S.

Cis-1,2-DCE in Shallow Wells for the April 2012 Event

The highest cis-1,2-DCE detection, 3,600 D µg/L, was found in the sample from MW-5S. Concentrations were at least an order of magnitude lower in the other shallow wells sampled. The next highest detections of cis-1,2-DCE were 610 µg/L in MW-11S, 220 µg/L in MW-7S and 140 J D µg/L in MW-24S (the "J" indicates an estimated value).

PCE in Shallow Wells for the April 2012 Event

The highest PCE detection, 250 µg/L, was found in the sample from MW-7S. Like TCE, PCE concentrations in all shallow wells sampled were at least an order of magnitude lower than levels reported in MW-7S. The next highest detections of PCE were reported in samples from MW-5S and MW-11S, at concentrations of 71 µg/L and 20 µg/L, respectively.

1,1-DCE in Shallow Wells for the April 2012 Event

The highest 1,1-DCE detection, 330 J µg/L, was found in MW-5S. The next highest detections of 1,1-DCE were 270 ED µg/L in MW-15S and 180 µg/L in MW-11S.

1,1,1-TCA in Shallow Wells for the April 2012 Event

The highest 1,1,1-TCA detection, 380 µg/L, was found in the sample from MW-5S. Concentrations were significantly lower in all other shallow wells sampled except for MW-11S which had a detection of 250 µg/L.

2.2.3.2 April 2012 Deep Aquifer Zone Wells – Low-Flow Groundwater Sampling Results

Generally, and as shown on Figures 6 and 7, the COC constituents detected in the SAZ wells during the April 2012 sampling event were relatively the same as those detected since January of 2003.

<u>SDAZ Wells</u>

As displayed on Figure 6, the COC constituents detected in the SDAZ are generally the same as those detected during previous groundwater sampling events since January of 2003. The SDAZ COC detectable concentrations were reported in the samples collected from both of the SDAZ wells that were sampled for the March 2011 event. COCs detected in MW-5D for the April 2012 event were 1,1-DCE, cis-1,2-DCE, PCE and TCE. Site COCs detected in MW-19D for the April 2012 event were cis-1,2-DCE and TCE.

Figure 6 shows the distribution of COCs in the SDAZ wells for the April 2012 sampling event. Similar to the reported constituent results shown on Figures 4A, 4B and 4C from the CMS report, SDAZ constituents with reported concentrations above the EPA MCLs or IRA level during the April 2012 sampling event are shown in highlighted cells on Figure 6.

<u>Cis-1,2-DCE in SDAZ Wells for the April 2012 Event</u>

The constituent cis-1,2-DCE was reported at 8.8 μg/L in MW-5D and 0.14 J μg/L within the sample from MW-19D.

<u>PCE in SDAZ Wells for the April 2012 Event</u>

The constituent PCE was reported at 0.35 J μg/L in MW-5D and was not detected within the sample from MW-19D.

<u>TCE in SDAZ Wells for the April 2012 Event</u>

The constituent TCE was reported at 5.9 μg/L in MW-5D and 0.11 J μg/L within the sample from MW-19D.

<u>1,1-DCE in SDAZ Wells for the April 2012 Event</u>

The constituent 1,1-DCE was reported at 0.86 µg/L in MW-5D and was not detected within the sample from MW-19D.

<u>NDAZ Wells</u>

Generally, and as shown on Figure 7, the COC constituents detected in the NDAZ were the same as those detected during all previous groundwater sampling events since January of 2003 with the exception of MW-15D (new).

The highest NDAZ COC concentrations were reported in the sample collected from MW-20D. Monitoring well MW-20D is located immediately north of the Former Wet Lagoon and west of MW-10D, roughly parallel to bedrock strike.

The most frequently detected COCs in the NDAZ wells were cis-1,2-DCE, PCE and TCE which were detected in the all six of the wells sampled. Other frequently detected COCs included 1,1,1-TCA (three detections) and 1,1-DCE (four detections). Concentrations of constituents detected above EPA MCLs during the April 2012 groundwater sampling events are also highlighted on Figure 7.

<u>Cis-1,2-DCE in NDAZ Wells for the April 2012 Event</u>

The highest cis-1,2-DCE detection in the NDAZ was reported in the sample from MW-20D at a concentration of 170 D µg/L. The remaining reported concentrations ranged from 73 D µg/L in MW-12D to 1.2 µg/L in MW-17D.

<u>TCE in NDAZ Wells for the April 2012 Event</u>

The highest TCE detection in the NDAZ was reported in the sample from MW-20D at a concentration of 100 D µg/L. The next highest reported concentration was found in MW-12D at 57 D µg/L.

<u>PCE in NDAZ Wells for the April 2012 Event</u>

The highest NDAZ detection of PCE was reported in the sample from MW-20D at 25 B µg/L (the "B" indicates that the compound was reported in the blank and the sample). The remaining reported concentrations ranged from 5.9 D µg/L IN MW-12D to 0.14 J µg/L in MW-17D.

<u>1,1,1-TCA in NDAZ Wells for the April 2012 Event</u>

The highest NDAZ detection of 1,1,1-TCA was reported in the sample from MW-20D at 3.0 µg/L. The other two reported concentrations where 1.3 µg/L in MW-15D to 0.075 J µg/L in MW-12D.

<u>1,1-DCE in NDAZ Wells for the April 2012 Event</u>

The highest NDAZ detection of 1,1-DCE was reported in the sample from MW-20D at 20 µg/L. The next highest reported concentration was found in MW-15D at 3.7 µg/L.

2.2.3.3 April 2012 1,4-Dioxane Sampling Results

Groundwater samples from 11 monitoring wells were analyzed for 1,4-Dioxane via Method 522.

<u>SAZ Wells</u>

The constituent 1,4-Dioxane was detected in all six of the SAZ wells sampled. Detected concentrations ranged from 210 µg/L in MW-5S to 3.7 µg/L in MW-24S.

Deep Aquifer Zone Wells

<u>SDAZ Wells</u>

The constituent 1,4-Dioxane was detected in both SDAZ monitoring wells sampled during the April 2012 event. As shown on Figure 6, concentrations were 1.5 µg/L and 0.92 µg/L in the samples from MW-5D and MW-19D, respectively.

NDAZ Wells

The constituent 1,4-Dioxane was detected in all three of the NDAZ monitoring wells sampled during the April 2012 event: MW-15D(new), MW-20D and MW-22D. Reported concentrations ranged from 5.0 µg/L in MW-20D to 0.33 µg/L in MW-22D.

Conclusion

Over all, the concentrations reported for the 2011 and 2012 annual sampling events fall within the historic range of detections that have been reported since 2003. As seen since 2003, there are fluctuations in the concentrations for the COCs from event to event. There has not been a statistical decrease or increase in any particular TI Boundary Monitoring Well for the COCs.

2.3 Groundwater Potentiometric Surfaces

Based on the groundwater elevations measured in the shallow and deep aquifer zone monitoring wells during the March 2011 and April 2012 sampling events, potentiometric surface maps were generated for the SAZ, the SDAZ, and the NDAZ as shown in Figures 8 through 13. As mentioned in the CMS report, the most significant factor that influences the shallow and northern deep aquifer zone's potentiometric surfaces is the extraction of groundwater from the existing groundwater recovery and treatment system. The groundwater recovery wells consist of RW-1, RW-6S, and RW-10S. A summary of related system modifications, pumping durations, and pumping rates are presented below.

In the northern portion of the Site, the SAZ and NDAZ potentiometric surfaces continue to display patterns indicative of the effects of on-site pumping from the IRM groundwater extraction and treatment system. In particular, the potentiometric surfaces reveal that IRM pumping wells RW-1, RW-6S and RW-10S continue to maintain a localized influence over the direction of groundwater flow in both the SAZ and NDAZ beneath the northern area of the Site.

The SAZ and SDAZ potentiometric surfaces, in the southern portion of the Site, continue to display similar patterns from previous sampling rounds. These patterns indicate the potentiometric surfaces continue to be influenced by the residual overburden thickness and structure of the Brunswick Formation within the southern area of the Site. The Brunswick Formation influence was previously documented in a continuous water level study conducted from September 27 to November 18, 1999 by IT Corporation, and prior pumping tests conducted by Groundwater Technology in October 1992. Other factors such as seasonal groundwater fluctuations, IRM groundwater treatment system operations or nearby public water supply operations can have a localized influence on the SAZ, SDAZ and NDAZ.

The existing IRM groundwater treatment system had several modifications and some inoperable time since the submittal of the CMS report. These modifications and downtime were previously discussed in the Bi-monthly Progress reports. Below is a brief summary of the downtime since the last synoptic water level readings from July 2010 that appeared during the CMS phase.

Of the available 884 days from the timeframe spanning August 2010 to December 2012, the IRM recovery wells, RW-1, RW-6S and RW-10S have been in operation for 798 days, 752 days, and 826 days, respectively. The Bi-monthly Progress reports number 119 through 130 summarize the reasons (e.g., power outages, equipment fixes) for the downtimes.

As reported in the previous bimonthly progress reports, recovery well RW-1 continues to operate at approximately 50 gallons per minute (gpm), while RW-6S and RW-10S operate at approximately 9 gpm and 8 gpm, respectively. The average operational time for the IRM system wells, based upon the almost approximate 2.4 year timeframe referenced above, is 90%.

Based upon these observed natural groundwater level fluctuations and the reactivation of PBA-10, the previously recommended Site hydraulic control criteria from the CMS Report may no longer be applicable. As such, performance criteria will continue to be monitored through synoptic gauging on a monthly basis, evaluation of quarterly PBA-10 data and groundwater extraction and treatment system performance monitoring to ensure that Site hydraulic control is being maintained. Therefore the previously recommended approach (per the CMS report) of historical high water levels to ascertain Site hydraulic control will no longer be utilized. Comparisons will continue to be conducted through synoptic gauging on a monthly basis during future CMI phase groundwater extraction and treatment system performance monitoring to ensure that Site hydraulic control is being maintained. Below are the steps for preparing and analyzing future groundwater levels and potentiometric surfaces for Site hydraulic control.

- Langan will ensure the groundwater extraction and treatment system has been running for a minimum of one week prior to initiating any well gauging event. Langan will gauge all monitoring wells listed on Tables 5 and 6. For continued groundwater level monitoring, a synoptic groundwater level measurement event inclusive of all accessible Site monitoring wells will be conducted at the beginning of each annual TI Boundary monitoring well sampling event. Additionally, during once per month groundwater treatment system Operations and Maintenance (O&M) activities, synoptic groundwater measurements will be obtained.
- Langan will use the well gauging data and calculate groundwater elevations.
- The groundwater elevations will be imported into Groundwater Modeling System (GMS) to create Potentiometric Surface figures for the SAZ, NDAZ and the SDAZ.
- Comparisons will be conducted between previous well gauging data, potentiometric surface figures and PBA-10 quarterly data on a monthly basis during future CMI phase groundwater extraction and treatment system performance monitoring to ensure that Site hydraulic control is being maintained.
- Hydraulic control will be considered achieved once the resultant potentiometric surfaces continued to display an inward gradient indicative of hydraulic control via IRM system groundwater extraction.

2.3.1 March 2011 Potentiometric Surfaces

2.3.1.1 Shallow Aquifer Zone

The potentiometric surface for the SAZ monitoring wells during the March 2011 groundwater sampling event is displayed in Figure 8. Consistent with previous sampling events, the SAZ groundwater gradient in the southern and central portions of the Site appears to follow topography and the underlying bedrock dip, resulting in a north-northwest direction of groundwater flow. Also displayed in the previous sampling events is a well-defined, oval-shaped depression in the SAZ's potentiometric surface that exists at the northwestern portion of the Site. The measurement and existence of the depression is now inferred, based upon the TI Boundary wells, however the general oval shape still exists within the TI Boundary wells that were gauged. The groundwater elevations in monitoring wells located within the area of this depression (e.g., MW-10S, MW-12S, MW-13S and MW-14S) were found to be 30 to 40 feet lower than the groundwater elevation in MW-15S, and 40 to 50 feet lower than the elevations measured in the Site's southern SAZ wells (e.g., MW-1S (old) and MW-3S).

These higher groundwater elevations generally north to south (between MW-7S and MW-15S) has led to a greater groundwater gradient just outside of the depression. Based on the March 2011 SAZ potentiometric surface and the similarities to previous sampling events dating back to July 2008 (CMS report), the SAZ groundwater is still highly influenced and responding to the on-Site IRM groundwater extraction and treatment system pumping. The March 2011 SAZ potentiometric surface also displays that hydraulic control has been maintained.

2.3.1.2 Deep Aquifer Zones

<u>SDAZ Wells</u>

Figure 9 shows the potentiometric surface for the SDAZ monitoring wells as recorded during the March 2011 groundwater sampling event. The SDAZ groundwater flow direction appears to be consistent with previous groundwater sampling events, since July of 2007, and flows to the north-northwest and in the direction of bedrock dip. As referenced in the CMS report, the suggested influences from the PBA-10 well have not been displayed in the potentiometric surface of the SDAZ since before the July 2007 groundwater levels. PBA-10 was shutdown by the PBA on March 23, 2007. Prior to the PBA-10 shutdown, a potentiometric low was observed around MW-5D(new) which suggested pumping influences due to well PBA-10. The March 2011 groundwater levels also do not indicate influence from municipal supply well PBA-10.

As shown in Table 5, head differences (positive head potentials) between shallow and deep zone wells at each southern area monitoring well cluster ranged from 21 to 36 feet during the March 2011 event. Similar potentials have previously been observed during other synoptic events at the Site.

<u>NDAZ Wells</u>

Figure 10 shows the potentiometric surface for the NDAZ monitoring wells as recorded during the March 2011 groundwater investigation event. The potentiometric surface for the northern deep aquifer zone roughly mirrors that of the northern portion of the SAZ, and suggests groundwater flow in the direction of the active IRM groundwater treatment system recovery wells RW-1, RW-6S and RW-10S. The anomalously high groundwater elevation observed in monitoring well MW-15D, 320.83 feet above mean sea level (AMSL), is consistent with previously reported elevations for the well (since installation in February 2006).

2.3.2 April 2012 Potentiometric Surfaces

2.3.2.1 Shallow Aquifer Zone

As in previous observations, the SAZ groundwater gradient in the southern and central portions of the Site appeared to follow topography and bedrock dip, indicating a north-northwest direction of groundwater flow as shown in Figure 11. Also displayed on Figure 11, is the noticeable oval-shaped depression in the potentiometric surface in the northern end of the site. Groundwater elevations in monitoring wells located within this depression (e.g., MW-10S, MW-12S, MW-13S, MW-14S, and MW-15S) were found to be approximately 59 to 70 feet lower than the elevations measured in the SAZ wells located in the southern/uphill side of the Site (e.g., MW – 3S). The groundwater elevation level observed in MW-15S (272.89 AMSL) was significantly lower (approximately 45 feet) than the March 2011 event and has not been observed that low in MW-15S since before July 2008. Although the interconnection between the shallow aquifer and the deep aquifer zone is implied at this juncture, in the portion of the Site near the MW-15 well cluster, historical trends have indicated that the deep aquifer zone in the MW-15 well cluster area is influenced by the pumping of PBA-10, which was operational (re-activated in September 2011) during the monitoring event.

2.3.2.2 Deep Aquifer Zone

<u>SDAZ Wells</u>

Figure 12 shows the April 2012 groundwater sampling event potentiometric surface for the SDAZ monitoring wells. The general pattern of the groundwater contours is similar to that historically observed; however, groundwater levels were between seven and 31 feet lower than those recorded during the March 2011 sampling event. Lower groundwater elevations were especially prominent in MW-2D and MW-9D (approximately 28 feet lower) and MW-5D (approximately 31 feet lower). Previous studies have demonstrated that the SDAZ is generally not hydraulically connected to the SAZ and/or the NDAZ and is therefore not affected by the operation of the Site's IRM groundwater extraction and treatment system. The lower groundwater elevations in the southeastern edge of the Site (area of MW-2D to MW-5D) is the result of the re-activation of PBA-10 municipal supply well by the PBA.

As shown in Table 6, head differences (positive head potentials) between shallow and deep zone wells at each southern area monitoring well cluster ranged from 26 to 55 feet during the April 2012 event. Similar potentials have previously been observed during synoptic events but not to the degree in head difference displayed between wells of the MW-5 well cluster.

NDAZ Wells

The April 2012 groundwater sampling event potentiometric surface for the NDAZ monitoring wells is displayed on Figure 13. The NDAZ potentiometric is very similar to that of the northern portion of the SAZ, and suggests groundwater flow in the direction of the active IRM groundwater treatment system deep recovery well RW-1. The anomalously high groundwater elevation observed again in monitoring well MW-15D, 310.14 AMSL, is consistent with previously reported elevations for this well (since installation in February 2006). However, the groundwater elevation in MW-15D is approximately 10 feet lower than the reported level from March 2011. The lower groundwater elevation, as previously stated, is attributed to and coincide with the recent re-activation of the PBA-10 municipal supply well by the PBA.

2.3.3 Summary of Observations – Groundwater Potentiometric Surfaces

Groundwater potentiometric surfaces for the SAZ, NDAZ and SDAZ from March 2011 and April 2012 were similar to the potentiometric surfaces displayed in the CMS report for sampling events from July 2008 to July 2010. The only differences that were evident were in the depressed groundwater levels that were reported within some of the Site shallow and deep aquifer monitoring wells as a result of re-activation of the PBA-10 municipal supply well by the PBA on September 9, 2011. In the SAZ and NDAZ, the effects of IRM groundwater recovery continued to be observed from March 2011 and April 2012 as indicated by the groundwater elevations measured in SAZ and NDAZ monitoring wells and the resulting potentiometric surfaces that displayed an inward gradient oriented toward the Site IRM recovery wells.

During synoptic groundwater level measurement events conducted prior to the March 23, 2007 shutdown of PBA-10 well, a potentiometric low was observed around MW-5D (new) which suggested influence due to the pumping of well PBA-10, located east-northeast of the Site. Since PBA-10 stopped pumping on March 23, 2007, the groundwater levels collected during the July 2007 to April 2011 sampling events no longer indicated influence from municipal supply well PBA-10 (i.e., drawdown in SDAZ monitoring well MW-5D (new) in response to

PBA-10 pumping), and the SDAZ groundwater flow direction appeared to be to the north-northwest and in the direction of bedrock dip.

With the re-activation of the PBA-10 municipal supply well by the PBA on September 9, 2011, influences from PBA-10 were evident in the SDAZ during the synoptic groundwater event conducted on April 18, 2012. The re-activation of the PBA-10 has resulted in a groundwater flow direct in the SDAZ to the northeast along strike in the direction of PBA-10

2.4 Existing Groundwater Treatment System

The existing (i.e., IRM) groundwater extraction and treatment system has been in operation since 1993, and withdraws groundwater from three on-Site recovery wells. These wells, RW-1, MW-6S and MW-10S, pump on average 50 gpm, 9 gpm and 8 gpm, respectively. Based on the data collected over the past 12 months, RW-1, the primary hydraulic control well at the Site, had an average uptime of approximately 96% over the operating timeframe (since 1993).

The main components of the treatment system include an air stripper, two vapor-phase granular activated carbon (GAC) units (for the capture of COCs/control of vapor emissions from the systems' air stripper), and various ancillary equipment (e.g., two centrifugal blowers, air stripper sump pump, control panels, etc.). Groundwater is pumped from the three recovery wells, through a particulate filter (for removal of suspended solids), and then to the top of the air stripper. Counter-current air flow through the air stripper transfers the dissolved organics to the vapor phase. The airstream is routed through the vapor-phase GAC units to remove vapor-phase organics. Treated groundwater is discharged to the unnamed tributary behind the treatment building in accordance with the Site's National Pollutant Discharge Elimination System (NPDES) Permit (permit No. PA0056014). The design elements (e.g., size and operation) of the groundwater and extraction system is provided in the Operation and Maintenance Manual, Groundwater Recovery and Treatment System, AMETEK U.S. Gauge, Plant #2, July 1993.

Influent and effluent water samples are collected once per month, as required by the aforementioned NPDES permit, and analyzed for five COCs: 1,1- DCE, PCE, TCA, TCE and cis-1,2- DCE. Prior to September, 2008, these water samples were analyzed using

EPA Method 601; however, they are currently analyzed using EPA Method 624 (as approved by the PADEP in July 2008). At the request of the EPA, AMETEK expanded the required third and fourth quarter discharge monitoring report (DMR) groundwater sampling events for CY 2003 to include the collection of groundwater samples for analysis for 1,4-Dioxane via EPA Method 1624m. As a result of this change in the groundwater sampling program, all DMR monitoring and sampling events since September 2003 were expanded to include the collection of samples for 1,4-Dioxane. As of June 27, 2011, PALL Corporation no longer analyzes the 1,4-Dioxane effluent samples. AMETEK has transferred these services to Test America, Inc. Effluent water quality samples collected from the IRM groundwater extraction and treatment system on September 25th and October 9th, 2012 were analyzed for 1,4-Dioxane by EPA Method 8260B SIM.

Based on the water sample results for the 12 months, the VOC removal efficiency is approximately 99%. Average concentrations of TCE and 1,1-DCE found in effluent samples were 1.2 μg/l and 2.0 μg/l, respectively. The average effluent 1,4-Dioxane concentration over past year was 24 μg/l.

An application for renewal of the NPDES permit for the groundwater treatment system (i.e., outfall 001), and for the Site's stormwater outfall (i.e., outfall 002) was submitted to the PADEP on July 30, 2008. On October 14, 2008, the PADEP responded that the permit application was administratively complete and undergoing technical review, and on March 11, 2009, the PADEP approved the NPDES permit renewal application for the Site. The current NPDES permit became effective on April 1, 2009 and will expire on March 31, 2014.

Currently, two O&M visits are conducted each month for the groundwater recovery and treatment system. The first visit each month includes a completion of the established O&M checklist (e.g., system pressures, cleanliness of the filter, air flow rates, and effluent pH), performance of air quality monitoring, and collection of monthly air stripper influent and effluent water samples. The second O&M visit each month consists of completion of the O&M checklist and air quality monitoring.

Based on system performance, reported COC results in the proposed Site TI boundary monitoring wells, and reported hydraulic control/potentiometric surface data to date, AMETEK anticipates reducing the current O&M schedule to one visit per month and maintaining the groundwater recovery system operational parameters and pumping rates during the pending CMI Phase. To maintain system uptime, and facilitate a timely response to any problems with the system, AMETEK has installed an autodialer in the groundwater extraction and treatment system compound. The autodialer is connected to the system's recovery pumps and treatment systems (e.g., air stripper components), and can notify key AMETEK and Langan staff in the event of a process upset.

3.0 SELECTED REMEDY

The Final Remedy (i.e., corrective actions) for the Site will include continued operation of the current IRM groundwater extraction and treatment system, collection of monthly synoptic groundwater level measurements (for evaluation of system hydraulic control), the annual TI boundary monitoring well sampling events with reporting, and institutional controls is described in greater detail in subsequent sections of this report.

3.1 Technical Impractibility Zone

The TI zone is defined as the site property boundaries and the bedrock zones beneath the property. The IRM pump and treat system provides hydraulic control within the TI zone. The treatment system will remain in operation to clean up and control groundwater COC migration within the TI zone as long as the COC's in groundwater are above the MCL's.

Future TI Boundary groundwater gauging and sampling event data may be evaluated via geostatistical groundwater monitoring optimization procedures, such as the Mann-Kendall and Sen's Slope Estimator trend analyses methods as described in the Final Letter Report on the Additional Environmental Investigation Activities Conducted in July 2007, November 2007. If conducted, the findings of these evaluations would be reported to the EPA with a request to modify the sampling frequencies for COCs or 1,4-Dioxane, and/or the number of wells to be sampled within the proposed TI boundary network (and MW-21S,MW-21D (new), and MW-22D) during future monitoring and gauging events.

For continued groundwater level monitoring (i.e., for continued evaluation of the hydraulic control of Site groundwater afforded by the existing groundwater recovery and treatment system), a synoptic groundwater level measurement event inclusive of all accessible Site monitoring wells (see Tables 5 and 6) will be conducted at the beginning of each annual TI Boundary monitoring well sampling event. Additionally, during once per month groundwater treatment system operations and maintenance (O&M) activities (see section 3.2), synoptic groundwater measurements will be obtained. This groundwater data coupled with the quarterly PBA-10 data (provided by the PBA) will be analyzed to evaluate that Site hydraulic control is maintained.

As described in the CSM Report, exception based reporting, likely via electronic mail and telephone conversation, would be implemented to communicate a loss of Site hydraulic control (previously this was to be based on higher than average groundwater elevations, updated per methodology presented in Section 2) to the EPA, as well as possible corrective action options. This information will also be presented in the Annual report (refer to Section 4).

As stated in Section 2.4, in the event additional hydraulic control is needed, the groundwater recovery system could potentially be scaled up to its maximum rated and permitted capacity of 100 gpm (i.e., the maximum flow rate permitted for the system's existing air stripping components). Additional recovery wells, or conversion of current monitoring wells, such as the connection of MW-20S to the groundwater recovery and treatment system could be feasible; however, further study may be warranted before any connection work is implemented.

In summary the annual TI monitoring event will be as follows:

- Conduct in the month of April (or an alternative per approval of the EPA).
- All Site monitoring wells will have water levels gauged prior to the annual groundwater sampling event.
- Groundwater purge water will be processed through the groundwater treatment system.
- The 17 TI boundary monitoring wells will be sampled and analyzed for the COC's via method SOM01.2.
- The two sentinel monitoring wells MW- 21S, and MW-21D (new), will be sampled and analyzed for the COC's via method SOM01.2, and sentinel well

MW-22D will be sampled and analyzed for 1,4 Dioxane via method 522. The sampling protocol will be in accordance to the Revised Work Plan.

- The QC will be conducted in accordance with the Revised Work Plan. As revised in (USEPA's approval email dated February 15, 2005), 10 percent of the samples will be validated.
- During the monthly IRM treatment and extraction system O&M visit, all Site monitoring well water levels will be gauged.
- All results will be submitted to the EPA in the Annual report (see Section 4).

3.2 Groundwater Pump and Treat System

The IRM pump and extraction system will operate and provide hydraulic control of the aquifer as long as the COC levels in the groundwater are above MCL's. The system has been in operation since 1993 and has been effective in containing and remediating groundwater contamination. The systems components are described in Section 2.4 of the CMS. The total system recovery rate is approximately 65 gpm with the following recovery wells:

- RW-1 (former plant production well) at approximately 50 gpm;
- MW-6S (former monitoring well) at approximately 9 gpm; and
- MW- 10S (former monitoring well) at approximately 8 gpm.

If site conditions warrant, the influent recovery rate may be increased to improve or maintain hydraulic containment. If additional hydraulic control is needed, the current system could potentially be scaled up to its maximum rate and NPDES permitted capacity of 100 gpm.

In 2012, the installed autodialer on the control panel will be used to monitor existing system operational rates and uptime to support system maintenance on an as-needed basis. Influent and effluent water samples for NPDES permit compliance (Permit number PA0056014 Amendment 1) will be collected during the once per month O&M visit. Groundwater pumping and system discharge data will also be collected during this visit for annual reporting required by the Delaware River and Basin Commission (DRBC) Ground Water Withdrawal Docket No. D-93-25(G)-2). The O&M data will be recorded on the form provided in Appendix D. These reports will be provided in the Annual report along with overview of system performance.

Any repairs required to the system will be reported in the Annual report. If the system is not operational for more than 5 days, either for routine repair or by other circumstances such as a power outage, AMETEK will notify the EPA via electronic mail and telephone conversation.

3.3 Long- term Groundwater Monitoring

The Final Remedy includes long-term to be performed through groundwater sampling and gauging of the TI zone monitoring wells (17) and monitoring wells MW-21S, MW-21D (new), and MW-22D. The gauging of water levels will include all Site monitoring wells. Sections 3.1 and 3.2 provide the scope of work for the long-term monitoring program. The results will be summarized in the Annual report (see Section 4).

As stated in EPA's April 11, 2013 electronic email regarding EPA's comments on the AMETEK Draft CMI Report, concentrations in MW-05S began to increase after old MW-05D was abandoned and replaced with MW-05D(new), which prompted the need for MW-24S to verify the shallow VOC plume remained within the property boundary TI zone at that location. As shown in Figure 5, concentrations for all COCs in MW-24S increased from 2011 to 2012 as discussed in Section 2.2.3.1. It was indicated by the EPA that it appears there is an outward gradient from MW-05S toward MW-24S resulting in increasing concentrations (between the March 2011 and April 2012 sampling events) at MW-24S which indicate continued migration of the VOC plume in the shallow aquifer

During the April 4, 2013 conference call between EPA, Langan and AMETEK to discuss EPA's April 11, 2013 electronic email regarding EPA's comments on the AMETEK Draft CMI Report, the draft April 2013 groundwater sampling results (not presented herein) were reviewed indicating a lower COC concentration in MW-24S. These results are scheduled to be submitted to the EPA in the 2013 Annual report due on June 2, 2013. To further evaluate the COC trend in MW-24S, It was agreed that Langan would collect another set of groundwater samples from MW-05S and MW-24S, in additional to the April 2013 sampling event. This new sampling event will be will be completed as part of the long-term groundwater monitoring monthly monitoring well gauging event which will be conducted in the first week of June 2013. The sampling procedure and protocol will be the same as conducted in the previous April 2013 event. Instead of submitting the Annual report on June 2, 2013, Langan will include the results from the June 2013 groundwater sampling of MW-5S, MW-24S and the site-wide monitoring gauging event in the 2013 Annual report. Langan will submit the 2013 Annual report to the EPA prior to the July 1, 2013. Based on the 2013 groundwater results for MW-24S and MW-5S, further recommendations (e.g., increase sampling frequency, etc.) may be provided in the 2013 Annual report.

3.4 Institutional Controls

The Final Remedy will have land use and development restrictions with regard to the Site groundwater contamination for the area within the TI zone. The institutional controls will restrict the Site to non-residential purposes and will prohibit the installation of public or domestic groundwater supply wells within the TI zone. The institutional controls will be implemented through an environmental covenant pursuant to the Pennsylvania UECA.

An updated Site property survey and property boundary/description information was completed in 2011 and will be included in the submission of the draft Act 68 environmental covenant for the Site after the CMI report is approved.

4.0 REPORTING REQUIREMENTS

The Annual report will be submitted to the EPA approximately 2 months following the annual groundwater sampling event described in Section 3.0. The Annual report will contain the following:

- Validated groundwater analytical data (10 percent) for the COC's and 1, 4 – Dioxane will be tabulated and discussed relative to historical trends.
- The QC samples and protocol will be reported.
- The groundwater synoptic data will be tabulated and discussed relative to historical trends. This will include the annual and monthly events as described in Section 3. If the hydraulic control analysis discussed in Section 2.3 above, has two consecutive

monitoring events where the potentiometric surfaces do not display an inward gradient indicative of hydraulic control then AMETEK will inform the EPA via electronic mail or telephone conversation. The appropriate corrective action will be documented and instituted as deemed appropriate by all parties.

- The O&M of the groundwater treatment and extraction system will be summarized. The monthly O&M forms (Appendix D) will be attached. The following information will be discussed;
    - Recovery well influent rates.
    - Effluent discharge rates.
    - Influent and post-treatment VOC concentrations per the NPDES permit requirements.
    - Influent and post-treatment 1,4–Dioxane concentrations.
    - Repair history for the reporting period.
    - System operation up-time and reasons/fixes for downtime.
    - Institutional controls including any issues that may impact these controls will be discussed.
    - Path forward topics will be discussed as necessary.

4.1 System Performance Criteria

As discussed in Section 3, the remedy that has been in place and will continue in the CMI is an active groundwater extraction and treatment system. The performance criteria used to evaluate the effectiveness of the groundwater extraction and treatment system is:

1. Hydraulic Control – preventing impacted groundwater from migrating outside the TI Boundary.

2. Reduction of COC concentrations in groundwater to MCLs within the proposed network of Site monitoring wells, described above as the Site's TI boundary monitoring well network, and including MW-21S and MW-21D (new).

3. Ongoing monitoring to demonstrate the reduction of reported 1,4-Dioxane concentrations within the Site's proposed TI boundary monitoring well network

(as described above) and MW-22D. The EPA's Tapwater Risk Based Screening Concentration for 1,4-Dioxane of 6.1 µg/L will serve as a reference point for the evaluation of reported 1,4-Dioxane concentrations in groundwater, and a trigger for decisions on changes to groundwater monitoring procedures and/or groundwater recovery operations via the Site's IRM groundwater recovery and treatment system.

5.0 REFERENCES

- *The Final Administrative Order on Consent (Consent Order, Docket Number RCRA-III-030CA), June 11, 1990 (the United States Environmental Protection Agency).*
- *Preliminary Report of Results; Hydrogeological Investigation*, February 1990 (Groundwater Technology, Inc.)
- *Draft Hydrogeological Investigation Report for AMETEK, U.S. Gauge Division, Sellersville, Pennsylvania, December 1991 (Groundwater Technology, Inc.),*
- *Interim Measures for Nearby Private Wells*, April 26, 1993 (Groundwater Technology, Inc.),
- *Revised Work Plan for the RCRA Facility Investigation, AMETEK, U.S. Gauge Division Plant #2*, June 21, 1993 (Groundwater Technology, Inc.),
- *Operation and maintenance Manual, Groundwater Recovery and Treatment System, AMETEK U.S. Gauge , Plant #2*, July 1993 (Groundwater Technology, Inc.),
- *RCRA Facility Investigation AMETEK, U.S. Gauge Division Plant #2 Sellersville, Pennsylvania*, February 24, 1997 (Flour Daniel GTI)
- Revised Work Plan Report, April 27, 1999 (IT Corporation),
- Low-flow Purge Groundwater Sampling Letter, December 6, 2002 (Malcolm Pirnie, Inc.)
- Approval email for a 10% random validation of the March 2011 VOC and 1,4-Dioxane groundwater data, February 15, 2005 (*United States Environmental Protection Agency)*
- *Final Corrective Measures Study Report, January 28, 2011 (Malcolm Pirnie, Inc.)*
- *Final Revised Statement of Basis, January 28, 2011 (Malcolm Pirnie, Inc.)*
- *Final Meeting Minutes 03-15-11, April 1, 2011 (Malcolm Pirnie, Inc.)*
- *Bimonthly Progress Report No. 122 May – June 2011, July 11, 2011 (Arcadis/Malcolm Pirnie, Inc.)*
- *Final Statement of Basis and Remedy, June 11, 2012 (the United States Environmental Protection Agency)*
- *Final Decision and Response to Comments, June 11, 2012 (the United States Environmental Protection Agency)*
- *Bimonthly Progress Report No. 127 May – June 2012, July 7, 2012 (Langan Engineering & Environmental Services, Inc.)*
- *AMETEK December 2012 Summary Report for Polychlorinated Biphenyl (PCB) Characterization/Remediation Letter, January 15, 2013 ((the United States Environmental Protection Agency)*
- *RCRA Facility Investigation Addendum and Final Letter Report on the Additional Environmental Investigation Activities Conducted in November 2007,* June 2008 (Malcolm Pirnie, Inc.)

- *Final Corrective Measures Study Report, January, 2011 (Malcolm Pirnie)*
- *Final Corrective Measures Study Report-EPA Approval Letter, March 31, 2011 (the United States Environmental Protection Agency)*
- Final Decision and Response To Comments on Selection of Corrective Measures Under 3008(h(of the Resource Conservation Recovery Act, AMETEK, U.S. Gauge Division-Plant # 2, Sellersville, Pennsylvania, dated June 8, 2012
- Bi-Monthly Progress Report No. 119, January, 2011 (Malcolm Pirnie)
- Bi-Monthly Progress Report No. 120, March, 2011 (Malcolm Pirnie)
- Bi-Monthly Progress Report No. 121, May, 2011 (Malcolm Pirnie)
- Bi-Monthly Progress Report No. 122, July, 2011 (Malcolm Pirnie)
- Bi-Monthly Progress Report No. 123, September, 2011 (Malcolm Pirnie)
- Bi-Monthly Progress Report No. 124, November, 2011 (Arcadis-US, Inc.)
- Bi-Monthly Progress Report No. 125, January 2012 (Arcadis-US, Inc.)
- Bi-Monthly Progress Report No. 126, March 2012 (Arcadis-US, Inc.)
- Bi-Monthly Progress Report No. 127, May 2012 (Langan)
- Bi-Monthly Progress Report No. 128, July 2012 (Langan)
- Bi-Monthly Progress Report No. 129, October 2012 (Langan)
- Bi-Monthly Progress Report No. 130, December 2012 (Langan)